Physical Chemistry

DIRECT OBSERVATION OF POLOXAMER 188 INSERTION INTO LIPID MONOLAYERS

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ABSTRACT

P188, a triblock copolymer of the form poly(ethylene oxide)-poly(propylene oxide)-poly(ethylene oxide)(PEO-PPO-PEO) helps seal electroporated cell membranes, arresting the leakage of intracellular materials from the damaged cells. To explore the nature of the interaction between P188 and cell membranes, we have constructed a model system that assesses P188's ability to insert into lipid monolayers. Using concurrent Langmuir isotherm and fluorescence microscopy measurements, we find that P188 changes the phase behavior and morphology of the monolayers. P188 inserts into both dipalmitoylphosphatidlycholine and dipalmitoylphosphatidylglycerol monolayers at surface pressures equal to and lower than about 22 mN/m at 30º C; this pressure corresponds to the maximum surface pressure attained by P188 on a pure water subphase. Similar results for the two phospholipids indicate that P188 insertion is not influenced by headgroup electrostatics. Because the equivalent surface pressure of a normal bilayer is on the order of 30 mN/m, the lack of P188 insertion above 22 mN/m further suggests the poloxamer selectively adsorbs into damaged portions of electroporated membranes, thereby localizing its effect. P188 is also found to be "squeezed out" of the monolayers at high surface pressures, suggesting a mechanism for the cell to be rid of the poloxamer when the membrane is restored.